

# AIR POWER REVIEW

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# **“Air Power and the Environment: The Ecological Implications of Modern Air Warfare”**

**By Dr Joel Hayward<sup>1</sup>**

Ecologists, activists, lobbyists and of course politicians are already turning their attention to ecological aspects of modern warfare. As a consequence, governments and their armed forces will have to pay more attention to the serious ecological ramifications of conflict. Air forces face the greatest challenges. During both peace and war they have far greater carbon footprints than armies and navies. They use potentially more devastating ordnance. Their targets traditionally include objects in or near population centres and the aquifers, waterways, soils and food sources that sustain them. And air forces cause far worse damage to environmentally significant production, storage and distribution infrastructure (much of it based on petroleum, oil, lubricants or chemicals). This article does not recommend the blanket exclusion of any potential target sets from planning processes. Rather, it argues that, when we utilise our existing warrior code, the Just War ethical framework, we must now slightly expand our time-honoured moral and legal constructs of proportionality and discrimination to include environmental issues. That is, the article argues for the inclusion of ecological protection in military planning and for it to be weighed expertly, along with the likely need for post-war remediation activities, among the factors that will ultimately determine the justifiability of military actions.

## Introduction

Twenty years ago the Norwegian Prime Minister, Gro Harlem Brundtland, stated: "We are living in an historic transitional period in which awareness of the conflict between human activities and environmental constraints is literally exploding."<sup>2</sup> We have come a long way in the subsequent two decades. Environmental responsibility now lies at the forefront of our western world perspective and is constantly growing in importance. Ecological activism, which used to be a fringe movement, has now become mainstream. In 2007 Al Gore and the Intergovernmental Panel on Climate Change won the Nobel Peace Prize (and an Oscar!) for their efforts to raise environmental awareness. Greenpeace, which uses "non-violent, creative confrontation to expose global environmental problems," alone has no fewer than 220,000 members in the United Kingdom and 2.8 million worldwide. Ecologists, environmentalists, activists, lobbyists and of course strategists are already turning their attention to ecological aspects of modern warfare, including land mines, cluster ordnance, erosion and soil damage, air pollution, deforestation, nuclear testing and proliferation, oil spillage and fires, depleted uranium contamination, the disposal of ordnance, and so forth. It seems likely that such concerns will also become increasingly mainstream. As a consequence, governments and their armed forces will be paying more attention to the serious ecological ramifications of conflict. Some already are. The *Global Strategic Trends* paper published by the Ministry of Defence's Development, Concepts

and Doctrine Centre (DCDC) illustrates the importance now being placed on these matters by some British strategists.<sup>3</sup>

Balancing strategic and operational needs with both military and environmental ethics is certainly not impossible, and responsible armed forces are already beginning to think about how best to balance what superficially seem to be (but actually are not) competing imperatives. Air forces face the greatest challenges. During both peace and war they have far greater carbon footprints than armies and navies. They use potentially more devastating ordnance. Their targets traditionally include objects in or near population centres and the aquifers, waterways, soils and food sources that sustain them. And air forces cause far worse damage to environmentally significant production, storage and distribution infrastructure, much of which is based on petroleum, oil, lubricants or chemicals.

My philosophical framework should be easy to understand. Although I recognise intrinsic worth in the natural environment - meaning it has a value in its own right regardless of what humans gain from it - I am primarily concerned with its instrumental value. That is, I argue from an anthropocentric vantage point that we should safeguard the environment and its myriad complex ecosystems because humans are part of those ecosystems and their security, health and happiness depend entirely upon them. I see no conflict or inconsistencies between environmental ethics and the ethics of war. Western warriors increasingly understand that the environment is

in many ways the collective property of all humanity, including future generations, and that its responsible stewardship is critical regardless of the good and bad governments and regimes that might exist at any given time within man-made boundaries. In this respect the environment is highly akin to the "cultural property" that the 1954 Hague Convention for the Protection of Cultural Property makes illegal to damage or destroy deliberately.<sup>4</sup> The physical environment's significance is actually inestimably greater than the "property of great importance to the cultural heritage of every people" - including unique architecture, archaeological sites and other objects of artistic, historical or cultural importance - that the Convention considers inherently valuable and morally inappropriate as targets of military action.

Moreover, the West's ethical framework for understanding armed conflict, Just War, forms a sizeable chunk of the western warrior code. Within this code warfare is a regrettable activity directed against the culpable, undertaken only when a better state of peace is the likely outcome and if the good accomplished outweighs the harm done. Deeply embedded within Just War are concepts of proportionality and discrimination. In terms of *jus in bello* (the criteria for fighting wars "cleanly"), proportionality means that military forces must not undertake any actions in which the incidental harm would be excessive in relation to the likely military benefit. Throughout my own career of teaching military officers I have ordinarily summarised this concept by encouraging them never to use more force or to cause more damage

than is necessary to guarantee the attainment of just military goals. Similarly, discrimination means that military forces may only wage war on combatants and military objects, and must act purposely and painstakingly to ensure that civilians suffer no more harm than military necessity demands. It is thus eminently logical that, as western warriors are framing their use of force in terms of minimising suffering while doing good, all the while protecting the innocent, including those on the other side, they should understand the importance of minimising harm to the very environment and habitat that sustain the innocent. It is equally reasonable that, as the purpose of military activity is a better state of peace, it would be incongruous to inflict damage upon the innocents within the opposing state, and possibly within neighbouring states, that lasts well beyond the end of conflict and complicates the restoration of harmony.

Lastly, I strongly disagree with those ecologists who assert that we need to take an absolutist stance against all military activities that result in any ecological harm. Our Just War criteria are adequate as a guide for military planners and practitioners. Both proportionality and discrimination involve careful calculations that render some regrettable harm acceptable when balanced against the greater good being achieved. I accept this line of reasoning and argue, not for absolutist prohibitions, but for the inclusion of ecological protection in all military planning and for it to be weighed expertly, along with the likely need for post-war remediation activities, among the factors that will ultimately determine the justifiability

of military actions.

This article draws on the Kosovo Conflict as its central case analysis so as to give readers something recent upon which to reflect that does not involve the emotionally charged War on Terror. (Equally powerful examples of environmental harm caused by air power and other forms of military force can also be found during that so-called war.) The article is not intended as the last word on the subject of the real and potential ecological ramifications of modern air power, but merely as a first word. It aims to demonstrate some complexities within the closely intertwined relationship between defence and security priorities, international humanitarian law, the West's Just War framework and environmental ethics. It offers several observations and asks a set of questions in the hope that readers will feel prompted to seek their own answers. It is my belief that air forces should engage these issues proactively, addressing them on their own terms with judgement and at a realistic tempo before public pressure and special interest groups might compel defence ministries to make sweeping changes, some of them possibly rushed and unhelpful.

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Since ancient times armies have often consciously used the natural environment as a weapon against opponents. They have poisoned wells, salted fields, burned crops and done other ecologically harmful things. In 1945, for example, German officers who feared an Allied attack intentionally flooded 20,000 hectares of agricultural land in the Netherlands, leaving it unusable

for crops until the Dutch finally reclaimed the land four months later after a massive rehabilitation program. I began thinking about the ecological implications of modern air warfare when, as an undergraduate, I studied the environmental damage caused by the RAF bombing of the Möhne and Edersee dams in May 1943 and the USAF atomic bombing of Hiroshima and Nagasaki in August 1945. I was surprised most of all to learn the full extent of the American defoliation programme during the Vietnam War, which represented a watershed in the relationship between warfare and the environment. Between 1962 and 1971 US aircraft sprayed 3,640 km<sup>2</sup> of South Vietnam's croplands, deep vegetation and jungles with 55,000 metric tonnes of herbicides and defoliants in order to destroy the plant-based ecosystem for the purpose of disrupting agricultural food production and destroying plant cover for the Viet Cong.<sup>5</sup> Its effects were dreadful for Vietnam's ecosystems and, most infamously, for human health.

My thinking about the relationship between warfare and the environment began to focus in March 1999, when NATO air power began wrecking Yugoslav (especially Serbian) infrastructure in a well-intended but poorly conceived attempt to coerce Slobodan Milošević's government into protecting and granting more freedom to the beleaguered Albanian ethnic majority of Kosovo and Metohija. I felt disappointed that, even in our era of effects-based operations and precision strike capabilities, NATO chose to wreck almost all major oil refineries, petrochemical installations and fertiliser works, as well as their

tankage areas. NATO thereby spilled harmful oil and toxic chemicals into the soil, aquifers and waterways - including into the Danube River, the crucial economic artery of several unininvolved nations - and created carcinogenic, mutagenic, toxic and perilous airborne pollution. These acts were widely publicised and highly controversial. Like many concerned observers, I wondered why, in a war fought for humanitarian purposes, with a highly commendable, almost obsessive desire to ensure the totally accurate placement of ordnance so as to minimise immediate civilian deaths, NATO nonetheless seemed reckless with Yugoslavia's natural environment.

I began researching this particular article in July 2006 after feeling equal disquiet when Israeli Air Force air strikes created a dreadful six-mile wide and 100-mile long oil slick along the Lebanese coast by striking an oil storage depot at the Jiyeh power plant, about nineteen miles south of Beirut, flooding 15,000 tonnes of oil into the Mediterranean and causing the worst-ever oil spill in that sea. A further 25,000 tons burned for 27 days, reportedly "spewing a toxic cloud into the air and causing a rain of toxic oil downwind."<sup>6</sup>

Targeting oil infrastructure from the air is not new. During the Second World War, for instance, both Allied and Axis air forces considered oil production, refinement, storage and transportation facilities and systems as integral to their enemies' viability and survivability. Even the Luftwaffe, designed and utilised primarily for battlefield interdiction and attack, bombed Caucasian oilfields in 1942 in an angry attempt to punish the

Soviet Union.<sup>7</sup> During the last three months of the Pacific War, the USAAF conducted a weighty campaign aimed at destroying Japan's oil infrastructure.<sup>8</sup> The greatest counter-oil campaigns occurred during 1943 and 1944, when the USAAF struck the Romanian oilfields and refineries that supplied a large portion of Germany's oil and both the RAF and the USAAF wrecked synthetic fuel plants across Germany.<sup>9</sup>

The targeting of oil sharply divided senior Allied air commanders, but only because some of them passionately argued against its purported strategic effectiveness and not because anyone felt gravely worried about the natural environment.<sup>10</sup> Occurring decades before scientists began expounding concerns about "acid rain," "sustainability," "carbon emissions" and the "greenhouse effect," and during a war in which neither side worried much about the suffering of enemy populations, these great campaigns caused levels of local environmental harm that were not analysed in any of the major post-war bombing surveys and which would be unacceptable in any of today's limited wars.<sup>11</sup>

I would not dream of casting stones at our valiant forebears. It would be wrong to impose the widespread ecological values of today onto previous generations. Moreover, we cannot attribute responsibility for large-scale oil pollution during the Second World War solely to air forces. For example, navies, equally unaware of the long-term harm likely to occur, targeted and sank not only fuel-laden warships, but also each other's merchant ships, including

oil tankers. Indeed, the combined gross registered tonnage of the oil tankers sunk was 1,235,097 with a total oil-carrying capacity of as much as 17,171,183 barrels or 2,592,380 tonnes.<sup>12</sup> That is the equivalent of one *Exxon Valdez*-size spill occurring every month of World War II.

Petroleum, oil and lubricants (often simplified as “POL”) infrastructure remained a primary target set for air power planners throughout the Cold War and following decades, and featured prominently, for example, in the USAF’s and USN’s Rolling Thunder and Linebacker bombing campaigns against North Vietnam.<sup>13</sup> In 1988 the most celebrated air power thinker of recent times, John Warden III, maintained that the “petroleum chain ... still remains a potentially key target simply because a modern military machine cannot function without fuel.”<sup>14</sup> Indeed, Warden argued that, along with electricity, oil was a major centre of gravity (one of his five “rings”) and that carefully focused attacks on the oil chain would denude the enemy of energy. Warden’s ideas influenced the Gulf War of 1991, during which Coalition air forces wrecked Iraqi oil storage and distribution installations - but not all long-term export infrastructure - as part of a campaign aimed at paralysing Saddam Hussein’s state and forces.<sup>15</sup> (The Iraqis created far more devastating environmental harm when they detonated more than 700 Kuwaiti oil wells, igniting over 600 of them, and discharged more than six million barrels of crude oil directly into the Persian Gulf. Happily for air power advocates I must note that precision air strikes by USAF F-111Fs against pumping stations and manifolds actually stemmed that

horrific flow.<sup>16</sup>)

Warden and other air strategists of his generation did not analyse (and to be fair probably gave no thought to) the key problem with destroying or damaging oil infrastructure, as opposed to merely disrupting distribution. They ignored the fact that liquid hydrocarbons and the chemicals utilised in refinement are potentially extremely damaging to ecosystems. The explosive or incendiary force of ordnance either burns the petroleum upwards, creating potentially deadly air pollution, which may cause dreadful health problems in the short-term (but thankfully seldom causes lingering harm after the pollution dissipates), or spills it into the ground, with the potential for long-lasting and calamitous contamination of soils, aquifers and waterways. As the Commentary on the 1977 Additional Protocols to the Geneva Conventions states: “As regards the destruction and setting alight of refineries and petroleum storage facilities, it is hardly necessary to stress the grave danger that may ensue for the civilian population”.<sup>17</sup>

NATO’s 1999 attacks on Yugoslavian refineries and petrochemical and fertiliser installations at Pančevo, Novi Sad and elsewhere created such demonstrable environmental pollution - with the wreckage, spills, fires and billowing clouds being captured on the handycams of local inhabitants as well as more expertly by journalists - that when the Serbian government accused NATO of creating an environmental catastrophe it was not a lone voice. Even the relevant watchdog agencies within the United Nations and other

reputable and non-partisan intrastate bodies expressed strong concerns about the attacks. Neither they nor western media could brush aside the Serbian governmental allegations (which exaggeratedly described the violence as “ecocide”) as merely unverifiable and unwarranted anti-NATO propaganda.<sup>18</sup> With many scores of thousands of Serbians evacuating towns and villages to flee from clouds of toxic chemicals, with slicks in the Danube and with some smoke plumes moving eastwards over Romania, Bulgaria, Moldova, Ukraine and the Black Sea<sup>19</sup>, it was impossible to deny that, even if only in the short term, the attacks had an adverse and widely concerning environmental impact.<sup>20</sup>

NATO argued emphatically that the one hundred or so industrial facilities it bombed throughout Serbia were “dual-usage” installations and thus legitimate targets according to sections of the 1977 Additional Protocol I to the 1949 Geneva Convention. For example, NATO described the Pančevo refinery and works, the largest petrochemical complex in the Balkans<sup>21</sup>, as a “strategic target” that “provided oil and other elements to support the Yugoslav Army. By cutting off these supplies [NATO] denied crucial material to the Serbian forces fighting in Kosovo.”<sup>22</sup> Although civilian facilities are ordinarily strictly off limits, Article 52(2) does indeed permit attacks on those facilities “which by their very nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralisation, in the circumstances ruling at the time, offers a definite military advantage.”

The moral “double-effect” principle embedded within *jus in bello* also permits the targeting of dual-usage infrastructure and makes allowance for incidental civilian deaths if those deaths are *unavoidable*. Yet it permits this targeting only if it is *solely* intended to affect the capability of the opponent’s armed forces. If NATO’s intention was also to demoralise the Serbian population in order to generate additional pressure for the Milošević regime to capitulate, then the double-effect principle no longer provides justification for these actions.

Unfortunately, this seems to have been the case. Even if one chooses to argue that oil refineries were providing fuel for military operations as well as for civilian consumption, and were thus reasonable “dual-usage” targets, it is harder to make an equally strong case for pharmaceutical factories, car factories and even fertilizer plants.<sup>24</sup> The view that NATO wanted to put pressure on Milošević by squeezing and scaring his people by wrecking things around and amongst them gains support from the US military’s own reported admission to Human Rights Watch that NATO destroyed some targets that were not legitimately “dual-usage” and did so because they were “symbolic” and “psychologically lucrative.”<sup>25</sup> Human Rights Watch found that such actions were “done more for psychological harassment of the civilian population than for direct military effect.” This conclusion is reinforced by an ironic source: the NATO Joint Air Component Commander, Lieutenant General Michael C. Short. “If you wake up in the morning,” he told the *Globe and Mail* on 26 May 1999, “and you

have no power to your house and no gas to your stove and the bridge you take to work is down and will be lying in the Danube for the next 20 years, I think you begin to ask, 'Hey, Slobodan, what's this all about?'<sup>26</sup> How much more of this do we have to withstand?" Perhaps with a boast, he later said that he had wanted the Serbian leadership "to wake up to a city that was smoking".<sup>27</sup> He even admitted that he had warned Serbian air force commanders: "The speed and the violence and the lethality and the destruction that is going to occur is beyond anything that you can imagine. ... If you force me to go to war against you, Belgrade will never look that way again - never in your lifetime, or your children's lifetime. Belgrade and your country will be destroyed if you force me to go to war."<sup>28</sup>

Even ignoring this unusual ethical position, NATO failed to explain convincingly why its remarkably precise and thus potentially highly discriminate air force needed to destroy the storage tankage, thus burning or spilling staggering quantities of liquid hydrocarbons and chemicals, rather than less harmfully targeting the adjacent but separate refinery installations, or, far better still, precisely hitting the more discrete river-port, road and rail-related nodes in order to stop the oil and chemicals' loading, transportation and distribution.<sup>29</sup> NATO did publicly explain on 3 May 1999 that it had damaged Serbia's main electricity stations and thus robbed the Serbian population of seventy percent of its electricity. Spokesman Jamie Shea even publicly stated that Milosević would thus know that NATO "has its fingers on the light switch ... we

can turn the power off whenever we need to and whenever we want to".<sup>30</sup> Yet NATO's information campaign included no real effort to explain why it was setting ablaze and flooding oil and chemicals in refineries and storage facilities and not, instead, merely "switching off" those installations by accurately targeting their internal and external sources of electricity. Aircraft did target and destroy local transformers at the sites, interrupting their functionality, so it is less clear why NATO still chose to inflict such heavy and dangerous damage to the oil and chemical tanks and plants. Further, NATO did not explain why, after a European Union total oil embargo of Yugoslavia came into effect on 30 April 1999<sup>31</sup> - "the tap is being turned off all across Europe," NATO's chief spokesman claimed on 30 April<sup>32</sup> - it continued to burn and spill huge quantities of oil and chemicals right up until the conflict's last days.

During the war NATO responded to accusations of grave environmental harm in a very strange fashion. Aware that the world rightly felt horror at the expulsion and panicked flight of 850,000 Kosovars, NATO exaggerated the physical harm being done to their abandoned dwellings by the Serbian Army and by Serb paramilitaries. It maintained at one point that there were then "200 burning villages, town and cities" across Kosovo.<sup>33</sup> After presenting exaggeration as fact, it then relativised the environmental harm being committed by both NATO and the ethnic cleansers:

*[we] see a lot of smoke, the smoke is coming from all of these burning villages in Kosovo and if you're talking about environmental damage, I think the*

*"scorched earth" policy applied to Kosovo, the destruction of livestock, the destruction of rivers and roads and communication routes, the destruction of the agriculture, the slaughtering of a large percentage of the cattle and the livestock, is going to be much more significant in the long term and incidentally require a lot more money to fix than the repair of some oil refineries.<sup>34</sup>*

This *tu quoque* defence ("you can't criticise us for our wrongdoing because you're doing it too!") was disingenuous at best and dishonest at worst. Some Serbian regular army units and paramilitary groups did atrocious, murderous things in Kosovo, but they did not apply a "scorched earth" policy to the province, let alone cause or threaten a long-term environmental catastrophe involving the destruction of permanent natural features and resources. And the complaints levelled against NATO related to the imperilment of human life and widespread and potential enduring damage to fragile ecosystems, not to the cost of repairing oil refineries.

NATO's inadequate explanations and attempts at justifications did little to assuage concerns all over the world about *jus in bello* proportionality and thus the operation's justice. Even worse, NATO's actions and media ops failings resulted in accusations - and even formal charges presented at the International Court of Justice - of wilful and criminal contravention of Articles 35(3) and 55(1) of Additional Protocol I's explicit prohibition, regardless of the military objective, of "widespread, long-term and severe damage to the natural environment". Unlike other provisions of the same Protocol, once this threshold is met,

no exception can be made for "military necessity".<sup>35</sup>

Convincing critics that the level of wreckage remained proportionate was always going to be far more difficult for NATO than justifying the inclusion of the installations in its target sets. People believe what they see. And in 1999 they saw colossal destruction. I use the word "colossal" here with no desire for hyperbole. It may surprise some readers to learn that in total, NATO burned far more oil and dangerous chemicals into the air or spilled far more into the Serbian soils, aquifers and waterways in its 1999 air war than the 10.8 million gallons (257,000 barrels or 38,800 tonnes) of crude oil that the *Exxon Valdez* had spilled following its highly controversial grounding off the Alaskan coast in 1989.<sup>36</sup>

At Pančevo alone, NATO air attacks caused the release of 80,000 tonnes of oil and oil products, most of which burned wildly from ruptured tanks, poisoning the air only twelve miles from Belgrade's 1.5-million inhabitants with deadly substances including sulphur dioxide, nitrogen dioxide, carbon monoxide, polyaromatic hydrocarbons (PAHs) and lead. The Pančevo raids also spilled over 2,000 tonnes of toxic dichloroethane (EDC) into soils and groundwater, burned around 250 tonnes of vinyl chloride monomer (VCM, which would have produced toxic dioxins and hydrochloric acid), flooded around 250 tonnes of liquid ammonia and eight tonnes of metallic mercury, some of which entered a canal leading straight into the Danube. Desperately weighing the lesser and greater of two evils, the site managers themselves released

the liquid ammonia, knowing that a direct hit on stored ammonia had the potential to kill large numbers of people.<sup>39</sup> Another 73,000 tonnes of crude oil and oil products burned or seeped into the groundwater in the northern city of Novi Sad.<sup>40</sup> Elsewhere throughout Serbia (and Kosovo itself), heavy metals, sulfur dioxide, ammonia, and other caustics escaped from burning industrial facilities into the air, soil, ground waters and rivers, causing large-scale evacuations and leaving many experts convinced that the impact of the toxic releases would reach - as they did - far beyond Yugoslavia's borders.<sup>41</sup>

I am not for a moment suggesting that the long-term ecological consequences of the destruction at Pančevo and other sites exceeded those of the infamous *Exxon Valdez* spillage. The latter occurred in a highly fragile ecosystem in an area along the Alaskan coast so remote that clean-up proved tragically slow, difficult and incomplete. Little of the spilled oil could be burned, which, even though producing airborne toxins, would have reduced the destruction of flora and fauna caused by the concentrated surface "slick". This evaporated and decomposed far more slowly in the low temperatures than it would have under similar circumstances in more temperate climates.<sup>42</sup>

One cannot deny, on the other hand, that the environmental contamination at and around NATO's Serbian industrial targets was, at least in the short-term, so obviously severe that it greatly reduced NATO's ability to gain positive press from the fact that, in terms of minimising civilian deaths caused directly by bombing, it was

extremely successful.<sup>43</sup> Moreover, it alienated many influential observers, including former Soviet President Mikhail Gorbachev and others who had agreed with NATO's aims of ending ethnic violence, and caused highly unhelpful domestic controversy in NATO nations.<sup>44</sup>

Serbia employed a clever media strategy to draw the world's attention to the level of its environmental suffering, aware that, with no objective scientific teams being in-country and able to verify or challenge its claims during the conflict, NATO would have few options for countering its information (or misinformation) strategy.<sup>45</sup> This is something important for military planners nowadays to ponder. If their campaigns or missions cause even what appears to be large-scale ecological damage, their political leaders will find it difficult to mount a credible defence against charges of catastrophic harm. Garnering and maintaining popular support for wars of choice that involve no direct threats to sovereignty or key interests is not easy even within apparently reasonable contexts, but in this era of widespread public concern for the environment, politicians will find it easier to maintain support for their actions if they do not seem to be doing harm while claiming to be doing good.

In response to continued reports of widespread environmental harm, the Regional Environmental Centre for Central and Eastern Europe, assisted by a variety of specialist contracted experts, undertook the very first objective study.<sup>46</sup> It reported that, while thankfully there was "no evidence of a large-scale ecological

catastrophe, ... the environment in the whole territory of Yugoslavia was affected as a result of the military conflict". It also found that pollution was "very severe in the vicinity of targeted industrial complexes ... and many valuable ecosystems were disturbed."<sup>47</sup> It considered it too early to offer evidence-based opinions about the long-term effects, but warned that the environmental damage that had occurred or might in the future included threats to ecosystems (especially river systems) and human health caused by exposure to toxic or carcinogenic substances.

Likewise, at almost the same time, the very concerned United Nations Environment Programme took the unprecedented step of hastily forming a Balkans Task Force to assess the environmental consequences of NATO's air campaign. This was the first time that the UN had ever integrated environmental issues as a central part of a post-conflict humanitarian effort. Led by former Finnish environment minister Pekka Haavisto, the Task Force visited the wrecked refineries and industrial complexes in the weeks immediately after the cessation of violence and released its findings four months later. It detected four major ecological "hot spots" of grave concern that needed urgent attention (Pančevo, Kragujevac, Novi Sad and Bor), but added that permanent degradation of soils and waterways seemed unlikely. The UN team recognised that some of the environmental pollution apparently predated the NATO strikes while some of it resulted from it. The Task Force nonetheless added that urgent attention would be needed irrespective of the cause, "if

further damage to human health and the environment is to be avoided."<sup>48</sup>

The Task Force's report was not accepted by all scientists and interested bodies. Many considered it a "political" report supporting a pre-determined conclusion and relying on hasty and imperfect research and an inadequate methodology.<sup>49</sup> Better studies, the critics asserted, contradicted the Task Force's findings. They pointed to a parallel short-term study by the World Wide Fund for Nature, which highlighted the broader trans-boundary and ecosystem implications of the discharged toxic chemicals and offered the less positive summation that "toxic contamination in Yugoslavia is spreading".<sup>50</sup> The politically neutral Swiss-based FOCUS team of humanitarians and scientists that spent several months in 1999 assessing post-war damage throughout Serbia also offered this sombre assessment: "Destruction of many potentially dangerous objects on FRY territory caused the threat of ecological catastrophe."<sup>51</sup> Likewise, focusing especially on Novi Sad, two Belgrade scientists identified "catastrophic pollution".<sup>52</sup> They reported that, although airborne pollution was "extreme but short-lived," the pollution of the soil and surface and groundwater was long-term. "The pollution in these zones," they asserted, "especially in the Danube river basin, is a hazard for the further degradation of the environment, and a risk for the human health."<sup>53</sup> Similarly, and perhaps most notably, the US-based Institute of Energy and Environmental Research (IEER) expressed serious concerns in its 2002

assessment.<sup>54</sup> Particularly at Pančevo, chemical releases occurred “which pose potentially long-term threats to the local population and local environment.”<sup>55</sup> The IEER noted that, while it was impossible to be precise or to predict future circumstances with certainty because of a lack of available pre-war baselines, persistent toxins, carcinogens and other pollutants entering the ecosystems looked likely to have long-term negative consequences, including for human health. The IEER was very careful to apportion responsibility fairly and even criticised Serbia for its pre-war record of industrial pollution at some sites. It nonetheless reserved its strongest criticism for NATO for its inclusion of some of the petrochemical infrastructural targets and the excessive level of their physical destruction, reporting that “persuasive evidence indicates that humanitarian law may have been violated in the NATO bombing campaign, notably with respect to the bombing of Pančevo.”<sup>56</sup> The IEER went so far as to recommend:

*The entire issue of bombing civilian facilities to accomplish military objectives needs to become the subject of a rigorous public inquiry. Such an inquiry should include consideration of immediate and/or environmental and health damage that could be inflicted on the country or in neighboring countries sharing ecosystems with the countries at war.*

Given that NATO undoubtedly intended Operation Allied Force as a positive humanitarian intervention - with the ending of ethnic violence being the primary objective - even on balance such environmental degradation and explicit criticisms

of it can only be considered ultimately counter-productive. It weakens moral positions. Ethicist Alex J. Bellamy argues that humanitarian interventions place additional burdens of justice upon political leaders and military commanders than many other expressions of warfare. He notes that planners must pay particular attention to the selection of targets involving civilian objects and that, “in humanitarian interventions, failure to exhibit due care casts serious doubt on the legitimacy of the operation as a whole.”<sup>58</sup>

Just as any physician is morally obliged to cause no harm while seeking to remedy a patient’s malady, or at least to minimise all possible harm created by the treatment, responsible government institutions need to balance their security priorities and moral considerations with other influential factors, which nowadays includes environmental ethical considerations. It is not beyond reason to foresee a near future in which ecologists will sit alongside lawyers in campaign planning staffs and air targeting cells to offer advice or direction on the potential harm likely to be caused in specific missions. Their expertise in helping air planners to minimise harm to the very people they are trying to support should be welcomed, not feared. The moral shift away from old-fashioned concepts of collective responsibility, in which populations are punished or permitted to suffer harm because of the actions of their governments, as well as the strengthening of international legal protections of civilians, greatly increases the onus upon air planners to minimise every

form of so-called collateral damage. I disagree with some ethicists and lawyers who argue that, because of the likely release of “dangerous forces,” attacks on oil and petrochemical installations should be prohibited in the same ways that dams, dykes and nuclear generators are prohibited under the provisions of Article 56 of Additional Protocol I. Because meticulously planned and very precise attacks on oil targets need not cause “severe losses among the civilian population,” as defined by Article 56, I cannot accept the position that air planners must *never* target oil or petrochemical installations. When balancing competing priorities, particularly when a patient’s life is threatened, even the most compassionate of physicians may judge it necessary to dispense a treatment - chemotherapy, for example - that will kill peripheral healthy cells even as it targets the source of the threat to life. Of course, no doctor would prescribe these terrible treatments unless the patient’s illness was grave. Likewise, continuing with this analogy, the implementation of any significant environmentally risky or destructive measures should only be contemplated in military contexts involving tremendous need such as tipping-point moments in struggles of national survival. Ethicist Michael Walzer argues that during such “supreme emergencies,” a fear exists beyond the ordinary fearfulness of war, caused by dangers beyond the ordinary dangers of war (he means the imminence of defeat and enslavement<sup>59</sup>), and that such fear and danger may well require extreme measures that override ethical norms and even contravene law.<sup>60</sup>

NATO made a reasonable case in 1999 that the world community should not tolerate Serbian maltreatment of Kosovars. It represented a grave affront to the West’s core values. Yet the scale of ethnic violence, while sufficiently distressing to merit efforts to end it, did not constitute enough of a grievance - let alone anything close to a “supreme emergency” - in order to warrant the scale of violence of the armed intervention by NATO that inadvertently posed serious health risks to both Serbian and Kosovar civilian populations and caused much short-term and at least some long-term harm to the Balkans environment and its ecosystems.

Even without the gravity of the disputed issues of legality and morality, NATO’s destruction of Yugoslavian oil infrastructure did not even accord with sound military strategising. Planners who target an enemy’s cardinal energy systems must know that, with the exception of electricity which can be quickly interrupted, it will take a relatively long time for the desired effects of a counter-oil campaign to kick in. Destroying petrochemical installations and refineries and storage facilities will inevitably reduce the enemy’s ability to operate its armed forces effectively, but it will not do so swiftly, much less immediately, especially if the armed forces are (as Yugoslavia’s were) adaptable, lying low and not engaged in significant fuel-consuming movements or manoeuvres. Destroying enough oil infrastructure to paralyse armed forces will necessitate a massive and focused attack, or a lengthy and constant series of attacks. Even after seventy-eight days of increasingly powerful attacks, NATO had only

destroyed around forty percent of Serbia's military fuel stocks.<sup>61</sup> Whilst a counter-oil strategy might superficially seem eminently sensible for campaigns predicted to be protracted - and my view is that any such campaigns should be undertaken only with tremendous care, proportionality, precision and thought for the future - it is not an especially useful *modus operandi* for brief coercive strikes, particularly those with humanitarian goals.

We should not forget that the NATO planners intended Operation Allied Force to be a short and sharp *coercive* mission along the lines of Operation Desert Fox in December 1998. Indeed, Kenneth Bacon, the Pentagon's regular spokesman, announced on the eve of the first strikes on Serbia: "we have plans for a swift and severe air campaign."<sup>62</sup> Likewise, Secretary of State Madeleine Albright herself stated on 24 March 1999: "I don't see this as a long-term operation. I think it is achievable within a relatively short period of time."<sup>63</sup> The fact that Operation Allied Force lasted seventy-eight days cannot disguise the fact that it was intended to coerce Milošević into changing his mind on the violence in Kosovo within two or three days. As Tom DeLay, the United States House Majority Whip, commented one-third of the way through the campaign, "the Secretary of State, the Secretary of Defense, and the Chairman of the Joint Chiefs of Staff told us that this was no big deal, that we were going to bomb for a couple of days, 48 hours, and then stop bombing, and Milošević would come to the table".<sup>64</sup> Permanent destruction of oil refinement and storage facilities and other chemical works was thus at odds with the

original rationale of the mission, and makes little sense unless one attributes to NATO air planners a recognition some time in April - as I do - that their coercive strategy had failed and that the campaign had changed from coercion to denial and then to punishment.<sup>65</sup>

Moreover, astute and politically smart strategists and planners might want to reflect on the likelihood that in today's ecologically aware world, massive or sustained attacks on petrochemical installations - especially on their tank farms, which will cause sizeable poisonous spills and huge toxic fires - will generate politically destabilising arguments about proportionality, and thus the operation's justice. Refuting any public allegations over proportionality is not something a military wants to find itself having to do. It will have few objective and easily understandable criteria upon which to build a defence. The Just War concept of proportionality pertaining to non-combatants is complex and not helpfully defined in international humanitarian law. The legal explanation of proportionality is codified in Articles 51.5(b) and 57.2(a)(iii) of Additional Protocol I, which states that it is prohibited for the military to engage in any action "which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated."<sup>66</sup> A breach nowadays constitutes a war crime under the Statute of the International Criminal Court.<sup>67</sup> Unhelpful ambiguity exists on how anyone can objectively determine when an attack crosses the threshold and becomes

"excessive" (it is a comparative concept, not a measurable absolute concept) and how anyone can compare and evaluate such dissimilar values as civilian harm and military gain. Yet the consensus view and the *jus in bello* norm is, that when they wage war on combatants and military objects, military forces must act painstakingly, deliberately and carefully to ensure that civilians must suffer no more harm than military necessity demands. Suggesting that the drafters of Additional Protocol I also meant ensuring that the quality and habitability of the environment is not degraded would be hyperbolic. The environmental movement was far less motivated, powerful and ubiquitous in 1977 than it is now. Yet it is not unreasonable to foresee that (as I believe and recommend) a strengthening of both ethical and legal definitions will come to include these concepts.<sup>68</sup>

Tightening legislation is necessary. Opponents of any attacks that purportedly cause environmental harm and who desire to see prosecutions made against the perpetrators are currently not helped by the ambiguity of the wording in Additional Protocol I which prohibits "widespread, long-term and severe damage to the natural environment," regardless of the military objective.<sup>69</sup> The problem with this prohibition, of course, is that currently it is almost impossible to measure the threshold in specific and objective terms. Moreover, the adjectives "widespread, long-term and severe" are joined by the conjunction "and," which means that it is a cumulative triple standard that needs to be fulfilled. In other words, even an attack on a petrochemical plant that caused

widespread and horrific ecological harm might fail to meet this standard unless critics could demonstrate that its effects could also be measured in years, if not decades.<sup>70</sup>

Some critics of environmental degradation caused by air attacks have attempted to reduce this time-scale by drawing upon the 1977 Convention on the Prohibition of Military or Any Other Hostile Use of the Environmental Modification Techniques (ENMOD), written as a consequence of widespread criticism of the disastrous US defoliation programme in Vietnam. The ENMOD came into force in 1978 and was ratified by the US in 1980.<sup>71</sup> The ENMOD bans "military or any other hostile use of environmental modification techniques having *widespread, long lasting or severe* effects as a means of destruction, damage or injury to any other State Party" (emphasis added).<sup>72</sup> The Conference of the Committee on Disarmament defined these terms for the purpose of the ENMOD treaty in an Understanding Regarding the Convention:

- a) '*widespread*': encompassing an area on the scale of several hundred square kilometers;
- b) '*long-lasting*': lasting for a period of months, or approximately a season;
- c) '*severe*': involving serious or significant disruption or harm to human life, natural and economic resources or other assets.

Interestingly, the three criteria mentioned in the ENMOD are joined by the conjunction "or," rather than the "and" of Additional

Protocol I, meaning that it may not be necessary to fulfil a cumulative standard. Moreover, the Committee on Disarmament's explanation that "long-lasting" might mean "a period of months, or approximately a season," seems to suggest a more readily defined and reasonable threshold that would make prosecutions for environmental harm during wartime more likely. Indeed, if these criteria were applied to NATO's targeting selection process, the worst of the aforementioned attacks on petrochemical installations in Serbia, especially the destruction of Pančevo, might have been prohibited. Aaron Schwabach, an American law professor who has written extensively on the NATO campaign, concluded that it seemed "likely" that the damage at Pančevo would meet "at least one of these requirements."<sup>74</sup> Unfortunately for critics of NATO's war, the ENMOD's prohibitions do not automatically include all attacks leading to environmental harm, but only those activities undertaken in order deliberately to manipulate the environment's natural processes (by changing weather patterns or widespread defoliation, for example). Even more unhelpfully for those who seek to minimise environmental harm during wartime, the Committee on Disarmament's definition was not intended as a definition of Additional Protocol I (in addition to the ENMOD) and it is not even formally incorporated into the terms of the ENMOD. In other words, the definition actually serves to confuse matters, not to clarify them.

Given this lack of clarity over time-scales, making a compelling legal case that a state had committed

excessive harm to the environment is always going to be highly problematic immediately after the cessation of any hostilities, at least without new laws or a strengthening of existing laws. Compounding this problem is the fact that demonstrable, as opposed to merely threatened or even likely, human health problems (unusual cancers, for example) or damage to ecosystems may take years to appear and, within contexts in which little baseline public health and environmental information exists, may never be easy to measure, let alone place within an objective and provable analysis of causation. The emotions surrounding warfare, with inevitable finger-pointing from both sides, also make this type of analysis particularly problematic.

This was precisely the problem that Yugoslavia and various NGOs faced when they tried to bring a case against NATO before the International Criminal Tribunal for the Former Yugoslavia. To the dismay of many international legal experts and human rights groups, who accused her of accepting unbalanced evidence in favour of NATO<sup>75</sup>, Carla Del Ponte, the ICTY Prosecutor, informed the United Nations Security Council on 2 June 2000 that she had decided not to open a criminal investigation into any aspects of NATO's 1999 air campaign.<sup>76</sup> She specified that although NATO undoubtedly made mistakes, she felt "satisfied that there was no deliberate targeting of civilians or unlawful military targets by NATO during the campaign". More importantly for the purposes of this article, whilst accepting a finding that NATO had caused "some" damage to the environment, Del

Ponte rejected assertions that the Tribunal should prosecute NATO for causing excessive ecological harm. The main problem was not that the US and France had never ratified the Additional Protocols of 1977 (This was of course true. The US has still not ratified them and France only did in November 2001). Rather, Del Ponte accepted a review committee's finding that the "imprecise" phrasing in Additional Protocol I meant that it was extremely difficult to determine when any attacks during any wars had caused environmental harm exceeding the Protocol's threshold, especially as "long-term" would (despite the ENMOD-related advice) need to be "measured in years rather than months." The committee noted that, whilst it had "led to criticisms by ecologists," the vagueness of the standard meant that, "on the basis of information currently in its possession, the environmental damage caused during the NATO bombing campaign does not meet the Additional Protocol I threshold."<sup>77</sup> The issue of intent also created a problem:

*The requisite mens rea [measure of intent] on the part of a commander would be actual or constructive knowledge as to the grave environmental effects of a military attack; a standard which would be difficult to establish for the purposes of prosecution and which may provide an insufficient basis to prosecute military commanders inflicting environmental harm in the (mistaken) belief that such conduct was warranted by military necessity.<sup>78</sup>*

The current vagueness of international humanitarian law is also a problem for critics of air forces that use ordnance that the public consider

extremely ecologically harmful, such as white phosphorus bombs, cluster munitions and depleted uranium (DU) rounds. All three of these ordnance types have undeniably effective military roles when used only against enemy combatants. Yet for different reasons each one causes such highly controversial unintended secondary effects that many people consider *any* use to be reckless. Most environmentalists condemn them all as environmentally harmful. I also tend not to like their usage, especially in close proximity to civilians, but that is mainly because I recognise that the use of any contentious weapons will create destabilising controversy and add to unwanted propaganda battles. Moreover, I am not convinced that an adequate scientific consensus exists to allow me to argue with certainty, for example, that even the 30,000 DU shells fired at 112 locations in and around Kosovo by USAF A-10s caused (or will cause) serious and long-term environmental harm and that DU-contaminated areas should be treated with anything more than the "precautionary approach" recommended by the UN's environmental watchdog organisation.<sup>79</sup> Science may in time demonstrably undermine the UN's position, and I am mindful that the defoliation of Vietnam by Agent Orange and other defoliants has caused severe human health and environmental harm despite early US beliefs that no long-term harm to humans would occur.<sup>80</sup>

Cluster bombs are different from white phosphorus and depleted uranium shells in that they produce no secondary toxins that can cause chemical actions on life processes that might kill or harm humans,

animals or other living things. Yet they have a worse and more clearly proven influence on the natural environment. Cluster bombs' primary harm comes when widely spread and highly volatile unexploded submunitions cause the death and maiming of innocent people after - sometimes *long* after - the cessation of hostilities. 98 percent of the 11,044 recorded and verified casualties of cluster munitions in recent wars have been civilians.<sup>81</sup> In terms of the environment, cluster munitions have a very deleterious effect. Hundreds of thousands of fearful farmers in modern warzones avoid tilling submunition-contaminated fields, irrigating contaminated groves or orchards and raising livestock on contaminated grasslands. This has a seriously negative impact on local economies and on ecosystems. Cluster munitions also cause health and hygiene problems by creating malnutrition and denying safe access to water. In these ways they cause foreseen but unintended harm similar to, although individually far more lethal than, anti-personnel land mines. During NATO's war on Serbia, USAF and RAF (and a small number of Dutch) aircraft dropped a confirmed minimum of 1,254 cluster bombs in Kosovo (531 by the RAF which mainly targeted fielded forces and their weapons<sup>82</sup>). They scattered no fewer than 234,123 submunitions.<sup>83</sup> With a failure rate calculated at 7.8 percent, this means that NATO left 18,261 unexploded submunitions in or on the ground in Kosovo, none of them having self-destruct fuses. Thankfully, nearly all have now been located and cleared<sup>84</sup>, although 2,500 remain in Serbia proper<sup>85</sup> and Kosovo's litter of USAF and RAF

cluster submunitions has caused 152 post-war civilian casualties.<sup>86</sup>

Within the first year after the war's end, elements within the British Government were unhappy with the RAF's heavy use of cluster munitions. On 23 May 2000, a Report of the Foreign Affairs Select Committee of the House of Commons concluded: "We recommend that the UK Government consider carefully the experience of the use of cluster bombs in the Kosovo campaign to determine in future conflicts whether they are weapons which pose so great a risk to civilians that they fall foul of the 1977 Protocol and should not be used in areas where civilians live."<sup>87</sup> Likewise, on 23 October 2000, a Report of the Defence Select Committee of the House of Commons concluded that "our major contribution to the bombing campaign was in the form of unguided cluster bombs - a contribution of limited military value and questionable legitimacy."<sup>88</sup> It is therefore unfortunate that the RAF used them again (although nowhere as prolifically as the British Army) in Iraq in 2003, alongside the USAF, which had also used them in Afghanistan in and after 2001. Israel's air force, but especially its army, likewise used staggering quantities of cluster munitions in its 2006 campaign against Hezbollah insurgents and terrorists, leaving one million unexploded submunitions across southern Lebanon.<sup>89</sup> The unintended death and maiming rates of civilians in all three campaigns have been high and regretted and have seemed to undo some of the good that the various air forces and armies were trying hard to achieve.

A widespread western consensus

has quickly emerged that cluster munitions violate the *jus in bello* principles of proportionality and discrimination so grievously that they must be classed as weapons *mala in se*, which means "bad in themselves," irrespective of any legal prohibitions. The logic framing this consensus is consistent with both international humanitarian law and Just War principles. It argues that, because military forces nowadays can reasonably determine from objective analyses of recent conflicts that almost all cluster bomb victims will be civilians who will suffer death, maiming and environmental harm for many years after their initial use for military purposes, their harm cannot reasonably be balanced against any good achieved.

Modern wars have included many things *mala in se*, such as rape, torture, ethnic cleansing, chemical and biological weapons. Cluster munitions are the most recent addition to this category. In February 2007, forty-six national representatives met in Oslo to endorse a call by Norwegian Foreign Minister Jonas Gahr Støre to conclude a new legally binding instrument that will prohibit the production, stockpiling, transfer and use of cluster munitions and to provide adequate resources to assist survivors and clear contaminated areas. Subsequent International Oslo Process meetings occurred in Peru (May 2007), Austria (December 2007), New Zealand (February 2008), and Ireland (May 2008). 107 countries adopted the treaty text in Dublin and opened a signature process in Oslo on 3 December 2008. The Convention will enter into force six months after thirty states have submitted their Instruments of Ratification to the

Secretary General of the United Nations. Four states have now done so. The United States has neither signed nor ratified the Convention, although in March 2009 President Obama took a highly commendable first step by permanently banning the US sale of all cluster munitions except those (which is a tiny amount) that leave behind less than one percent of their submunitions as duds.<sup>90</sup> The United Kingdom has gone even further. It responded to the emerging *mala in se* consensus on cluster munitions responsibly and decisively by banning them in three stages; first on 20 March 2007 by withdrawing all of the RAF's 3,650 RBL755 "dumb" cluster bombs and their 536,550 submunitions as well as the British Army's 43,200 multiple-launch M26 rockets and their 27,820,800 submunitions; second in May 2008 by withdrawing the remaining Army cluster munitions which had (inadequate) self-destruct fuses; and third in December 2008 by signing the Convention outlawing all cluster ordnance.<sup>91</sup>

Even if we accept a *jus in bello* argument that, in any particular conflict a belligerent may foresee but not intentionally cause some environmental harm, we should also accept the *jus post bellum* argument that, after the end of hostilities and the restoration of what we hope will be a better state of peace, the restoration of the quality of life of the effected innocents should occur as fully as swiftly as possible. As the UN explains, this is not only a moral obligation, it is practical part of peacemaking and it nowadays extends to the human habitat and even beyond. "Environmental conditions - from the air that people

breathe and the water they drink, to the ecosystems that support forestry, farming and fishing - have a crucial influence on the success of efforts to rebuild shattered communities and livelihoods. Only by ensuring environmental security can the wider goals of post-conflict reconstruction and human development be sustained.”<sup>92</sup> In the case of the Kosovo Conflict the infrastructural damage was substantial and the environment harm severe in places. Swift remediation was crucial.

The United Nations Environment Programme (UNEP) took the unprecedented step of assuming responsibility for post-war remediation, concluding that “it was evident that, not only had people been through untold pain and suffering, but that the environment had suffered as well.”<sup>93</sup> It therefore immediately undertook to create a strategy to unite concerned nations in a programme to clean up the worst pollution and contamination in order to minimise long-term risks to Serbs, Kosovars and others. Its own 1999 Task Force, which had identified the four heavily polluted “hot spots” around Pančevo, Kragujevac, Novi Sad and Bor, served as the basis of its feasibility study to define the exact scientific and financial requirements for urgent clean-up projects at those and maybe other locations. In March 2000, clean-up measures for the four worst hot spots featured prominently as priority projects at the funding conference organized under the auspices of the Stability Pact for South-Eastern Europe. By the late summer of 2000, following positive initial responses from many governments, and pledges from several European countries to support

additional activities, the UNEP commenced a major environmental clean-up project at conflict-caused contamination sites in Serbia (including Kosovo). Over the next four years the UNEP mitigation and remediation project helped to secure fresh drinking water, remediated contaminated soil and groundwater, removed and treated scores of tonnes of extremely hazardous chemicals and waste, rehabilitated wastewater treatment capacities, installed environmental monitoring stations and strengthened national and local environmental management capacities.

Donor countries had pledged a total of twenty million dollars, but several reneged altogether or reduced their contributions. The UNEP had to make do with twelve million dollars and could not do everything it had wanted.<sup>94</sup> Its efforts nonetheless made a highly positive difference. After four years of intense industrial site, soil, and groundwater remediation work at the worst sites, the UNEP announced in May 2004 that, while the clean-up programmes had only addressed the most urgent issues, they had made such substantial progress with them that the ecological “hot spots” no longer warranted that label and that the programmes could be turned over to the Serbian government.<sup>95</sup> There was, and still is, much work left to Serbia to do before anyone can reasonably conclude that all environmental damage has been entirely negated.

It has now been ten years since NATO air power destroyed Serbian refineries and petrochemical installations and five since the UNEP ended its partial environmental clean-up campaign.

Yet Serbia is still deeply troubled by NATO's ostensible disregard of ecological responsibility. Unusually higher cancer rates, for instance, are still attributed to the effects of NATO's bombing campaign and even to its use of depleted uranium.<sup>96</sup> Establishing the verity of such claims is beyond my professional expertise, and might not even be possible for an oncologist or a public health expert, because of a lack of both baseline evidence and objective thorough studies and because of Serbia's continuing poor record of industrial pollution.<sup>97</sup>

### Conclusions

This study has demonstrated that modern air power has unequalled capacity for destructiveness within the human habitat and interrelated ecosystems of an opponent's state. Traditional target sets *still* include a lot of industrial plants and infrastructure that contain highly toxic and carcinogenic chemicals which can, if discharged through attacks, cause severe damage to the natural environment and its flora and fauna, not to mention human health. Any such environmental harm nowadays has far greater potential for causing destabilising controversy within the environmentally aware public than ever hitherto. Existing international humanitarian law is not yet adequate to discourage protagonists during the heat of war from attacking some things that perhaps should only be targeted under unique circumstances, with extraordinary care and after weighing potential wider implications. Existing conventions should be strengthened or new laws created. Yet the *jus in bello* concepts of proportionality and

discrimination embedded within our Just War code already *are* - or would be if more widely understood - an eminently reasonable basis for constraining the injudicious use of force against objects that have the potential for environmental harm. Western warriors already conceptualise their use of violence in terms of minimising suffering while doing good, all the while protecting the innocent, including the opponent's. It is a short and easy step of logic that they should understand the importance of minimising harm to the habitat of the innocent. It is equally logical that, as the purpose of armed violence should always be a better state of peace, warriors will want to avoid inflicting damage upon the innocents within the opposing state, and possibly within the wider region, that might last well beyond the end of conflict and therefore complicate the restoration of lasting peace. One of the lessons we should learn from the Kosovo Conflict - indeed, from Afghanistan, Iraq and Lebanon as well - is that most military commanders and planners are not adequately familiar with the key environmental sciences and are therefore not best placed to foresee all *unwanted* consequence as they plan operations and missions in order to achieve wanted effects. The inclusion of ecologists alongside lawyers in campaign planning staffs and air targeting cells to offer advice or direction on the potential harm likely to be caused in specific missions will at least partially strengthen the way that environmental factors can be "brought in from the cold". Their expertise in helping planners to minimise harm to the very people they are trying to support should be

welcomed, not considered intrusive.

## Notes

<sup>1</sup> Dr Joel Hayward is Dean of the Royal Air Force College. He is also Head of Air Power Studies at King's College London and a Director of the Royal Air Force Centre for Air Power Studies. He has written extensively on air power and teaches and lectures widely throughout Europe.

<sup>2</sup> Quoted in Philippe Antoine, "International Humanitarian Law and the Protection of the Environment in Time of Armed Conflict," *International Review of the Red Cross*, No. 291 (November-December 1992), p. 517.

<sup>3</sup> <http://www.dcdc-strategictrends.org.uk/>.

<sup>4</sup> *Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict*, 14 May 1954, Article 1(a).

<sup>5</sup> Jennifer Leaning, "War and the Environment," in Michael McCally, ed., *Life Support: The Environment and Human Health* (Boston: MIT Press, 2002), p. 278.

<sup>6</sup> Richard Steiner, "After the Bombs, Environmental Calamity," *Seattle Post-Intelligencer*, 10 September 2006. See also *Lebanon Post-Conflict Environmental Assessment* (United Nations Environment Programme, January 2007), especially pp. 42-46. Anthee Carassava, "U.N. Pledges \$64 Million for Cleanup of Oil Spill off Lebanon," *New York Times*, 18 August 2006. Richard Black, "Environmental 'crisis' in Lebanon," *BBC News*, 31 July 2006. Mati Milstein, "Lebanon Oil Spill Makes Animals Casualties of War," *National Geographic News*, 31 July 2006.

<sup>7</sup> See my own article, "Too Little, Too Late: An Analysis of Hitler's Failure in August 1942 to Damage Soviet Oil

Production," *The Journal of Military History*, Vol. 64, No. 3 (July 2000), pp. 769-794.

<sup>8</sup> *United States Strategic Bombing Survey (Pacific War)*, "Crude Oil Production and Refining" (Washington, DC: Government Printing Office, 1946).

<sup>9</sup> For Germany's reliance on oil, and the wartime consequence of this dependence, see my own article, "Hitler's Quest for Oil: The Impact of Economic Considerations on Military Strategy 1941-42," *The Journal of Strategic Studies*, Vol. 18, No. 4 (December 1995), pp. 94-135. See also Maurice Pearton, *Oil and the Romanian State 1895-1948* (Oxford University Press, 1971) and Jay A. Stout, *Fortress Ploesti: The Campaign to Destroy Hitler's Oil Supply* (Drexel Hill: Casemate, 2003).

<sup>10</sup> John Buckley, *Air Power in the Age of Total War* (London: UCL Press, 1999), p. 163. W. A. Jacobs, "The British Strategic Air Offensive against Germany in World War II," in R. Cargill Hall, ed., *Case Studies in Strategic Bombardment* (US Air Force History and Museums Program, 1998), pp. 147, 150, 167.

<sup>11</sup> Jay E. Austin and Carl E. Bruch, *The Environmental Consequences of War: Legal, Economic, and Scientific Perspectives* (Cambridge University Press, 2000), p. 120.

<sup>12</sup> M. M. Stephens, *Vulnerability of Total Petroleum Systems* (US Department of the Interior, Office of Oil and Gas, 1973), pp. 42-44.

<sup>13</sup> Mark Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (New York: Free Press, 1989). Ronald Bruce Frankum, *Like Rolling Thunder: The Air War in Vietnam, 1964-1975* (Lanham: Rowman & Littlefield, 2005).

<sup>14</sup> John A. Warden III, *The Air*

*Campaign: Planning for Combat* (1988. ToExcel edition, 2000), p. 39.

<sup>15</sup> Richard G. Davis, *On Target: Organizing and Executing the Strategic Air Campaign against Iraq* (US Air Force History and Museums Program, 2002). Thomas A. Keaney, "Surveying Gulf War Airpower," *Joint Force Quarterly*, Autumn 1993, pp. 25-36.

<sup>16</sup> Richard Hallion, *Storm over Iraq: Air Power and the Gulf War* (Washington: Smithsonian, 1992), p. 231.

<sup>17</sup> Yves Sandoz et al., eds., *Commentary on the Additional Protocols of 8 June 1977 to the Geneva Conventions of 12 August 1949* (Geneva: International Committee of the Red Cross, 1987), p. 669.

<sup>18</sup> This colourful phrase even made it into mainstream publications. See, for example, Vojin Joksimovich, "Militarism and Ecology: NATO Ecocide in Serbia," *Mediterranean Quarterly*, Vol. 11, No. 4. (2000), pp. 140-160.

<sup>19</sup> Z. Vukmirovic, L. Lazic, I. Tasic and M. Unkasevic, "Regional Air Pollution Originating from Oil-Refinery Fires under War Conditions," in Sven-Erik Gryning and Francis A. Schiermeier, eds., *Air Pollution Modeling and Its Application XIV* (New York: Springer, 2001), p. 741.

<sup>20</sup> Sriram Gopal and Nicole Deller, *Precision Bombing, Widespread Harm: Two Case Studies of the Bombings of Industrial Facilities at Pancevo and Kragujevac during Operation Allied Force, Yugoslavia 1999* (Institute for Energy and Environmental Research, 2002), p. 25. *The Kosovo Conflict: Consequences for the Environment and Human Settlements* (United Nations Environment Programme and United Nations Centre for Human Settlements (Habitat), 1999), p. 32. F. W. Carter and David Turnock, eds.,

*Environmental Problems of East Central Europe* (London: Routledge, 2002), p. 403.

<sup>21</sup> William Booth, "NATO Bombs Left Toxic Slough," *Washington Post*, 21 July 1999.

<sup>22</sup> Chris Hedges, "Serbian Town Bombed by NATO Fears Effects of Toxic Chemicals," *New York Times*, 14 July 1999.

<sup>23</sup> Gregory Reichberg and Heinrik Syse, "Protecting the Natural Environment in Wartime: Ethical Considerations from the Just War Tradition," *Journal of Peace Research*, Vol. 37, No. 4 (2000), p. 463. Carl Ceulemans, "The NATO Intervention in the Kosovo Crisis: March-June 1999" in Bruno Coppieers and Nick Fotiou, eds., *Moral Constraints on War: Principles and Cases* (Lanham: Lexington, 2002), pp. 205-228. But also see Jeanne M. Meyer, "Tearing Down the Façade: A Critical Look at the Current Law on Targeting the Will of the Enemy and Air Force Doctrine," *Air Force Law Review*, Spring 2001, pp. 172-173, 176-177, 181.

<sup>24</sup> Gopal and Deller, *Precision Bombing, Widespread Harm*, op. cit., p. 76.

<sup>25</sup> Meyer, "Tearing Down the Façade," p. 100. *Le Monde diplomatique*, 8 February 2000, found at: <http://www.monde-diplomatique.fr/cahier/kosovo/hrwo22000-en>.

<sup>26</sup> Short also said: "If you wake up in the morning and you have no power to your house and no gas to your stove and the bridge you take to work is down and will be lying in the Danube for the next 20 years ... at some point, you make the transition from applauding Serb machismo ... to thinking what your country is going to look like if this continues." *Daily Telegraph*, 25 May 1999.

<sup>27</sup> John A. Tirpak, "Washington Watch:

Short's View of the Air Campaign," *Air Force*, Vol. 82, No. 9 (September 1999), p. 43.

<sup>28</sup> PBS interview found at: <http://www.pbs.org/wgbh/pages/frontline/shows/kosovo/interviews/short.html>.

<sup>29</sup> Austin and Bruch, *Environmental Consequences of War*, p. 652.

<sup>30</sup> NATO Briefing, 3 May 1999, quoted in my article, "NATO's War in the Balkans: A Preliminary Analysis," *New Zealand Army Journal*, No. 21 (July 1999), p. 11. Shea's speech can be found at: <http://www.nato.int/Kosovo/press/p990503b.htm>.

<sup>31</sup> David Cortright and George A. López, eds., *Smart Sanctions: Targeting Economic Statecraft* (Lanham: Rowman & Littlefield, 2002), p. 95.

<sup>32</sup> Press Conference by Dr Jamie Shea and Brigadier General Giuseppe Marani, NATO HQ, 30 April 1999. This press conference can be found at: <http://www.nato.int/kosovo/press/p990430a.htm>.

<sup>33</sup> Press Conference by Dr Jamie Shea and Brigadier General Giuseppe Marani, NATO HQ, 18 April 1999. This press conference can be found at: [http://www.portaec.net/pacoc/warpeace/kosovo/nato/april99/o4\\_18\\_99.html](http://www.portaec.net/pacoc/warpeace/kosovo/nato/april99/o4_18_99.html).

<sup>34</sup> Press Conference by Dr Jamie Shea and Brigadier General Giuseppe Marani, NATO HQ, 30 April 1999. This press conference can be found at: <http://www.nato.int/kosovo/press/p990430a.htm>.

<sup>35</sup> Austin and Bruch, *Environmental Consequences of War*, p. 651. *Operational Law Handbook* (US Army: Juge Advocate General School, 2000), pp. 17-18.

<sup>36</sup> Figures published on the website of the Exxon Valdez Oil Spill Trustee Council: <http://www.evostc.state.ak.us/facts/qanda.cfm>.

[ak.us/facts/qanda.cfm](http://www.evostc.state.ak.us/facts/qanda.cfm).

<sup>37</sup> *The Kosovo Conflict: Consequences for the Environment and Human Settlements*, pp. 31, 34.

<sup>38</sup> *Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict: Preliminary Findings* (Szentendre: Regional Environmental Centre for Central and Eastern Europe, 1999), esp. § 4.1.1 and 4.1.2. Nevena Popovska and Jasmina Sopova, "The Pollution of the Balkans", *UNESCO Courier*, May 2000. Carter and Turnock, *Environmental Problems of East Central Europe*, p. 403. Austin and Bruch, *Environmental Consequences*, p. 649.

<sup>39</sup> Gopal and Deller, *Precision Bombing Widespread Harm*, op. cit., pp. 32, 33. *The Kosovo Conflict: Consequences for the Environment and Human Settlements*, p. 34.

<sup>40</sup> Ibid., p. 47.

<sup>41</sup> Ibid. and Claude V. Z. Morgan, "Collateral Damage of the Environmental Kind," *Mother Jones*, 6 September 2000.

<sup>42</sup> An excellent early study of pollution caused by warfare in arctic regions can be found in *Warfare in a Fragile World: Military Impact on the Human Environment* (Stockholm International Peace Research Institute / London: Taylor and Francis, 1980), pp. 114-125, 151.

<sup>43</sup> According to the *Final Report to the Prosecutor by the Committee Established to Review the NATO Bombing Campaign Against the Federal Republic of Yugoslavia*, NATO's campaign killed 495 civilians and wounded a further 820 (§ V (53)).

<sup>44</sup> For an example of Gorbachev's concerns, see his article, "Poison in the Air: The Environmental Cost of the Kosovo Conflict must be Exposed," *Guardian*, 18 June 1999. A trawl of

the internet will produce hundreds of archived mainstream media reports of the ecological damage caused by NATO's campaign. A useful sample are gathered on the website of the Serbian-American Alliance of New England and can be read at: <http://www.sane-boston.org/recentcrisesn.html>.

<sup>45</sup> Andrew J. Bacevich and Eliot A. Cohen, eds., *War Over Kosovo: Politics and Strategy in a Global Age* (New York: Columbia University Press, 2001), p. 15.

<sup>46</sup> *Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict: Preliminary Findings*, op. cit.

<sup>47</sup> Ibid., Executive Summary (no p. no.).

<sup>48</sup> *The Kosovo Conflict: Consequences for the Environment and Human Settlements*, pp. 9, 11.

<sup>49</sup> See Claude Morgan, "Collateral Damage of the Environmental Kind". In her 2000 paper, "Ecological and Health Consequences of the NATO Bombings of Pancevo and other Petrochemical and Chemical Industrial Complexes," now available on various internet sites, the late Dr Janet M. Eaton, a Canadian biologist and activist, typified these critics: The Task Force, "although composed of many expert scientists from around the world, was very limited in duration, lacked breadth and scope, failed to have within its mandate assessment of the impact on human health and lacked the cooperation of NATO authorities to either locate or assess the impact of depleted uranium weapons in spite of widespread concern and warnings about the ecological and health implications."

<sup>50</sup> World Wide Fund for Nature's

Danube Carpathian Programme, 1999, available at: <http://www.panda.org/crisis/background.html>.

<sup>51</sup> *FOCUS Assessment Mission 2 to the Federal Republic of Yugoslavia: Ecology, 18 July to 13 August 1999*. Bern: FOCUS: Greece-Russia-Switzerland-Austria Humanitarian Relief Operation Planning and Coordination Unit, 1999.

<sup>52</sup> Vesna Martinovic-Vitanovic and V Kalafatic, "Consequences of War Destruction of Oil Refinery-Nov Sad (Yugoslavia) on the Danube and its Biota," *Journal of Environmental Protection and Ecology*, Vol. 3, No. 2 (2002), pp. 370-376.

<sup>53</sup> Ibid.

<sup>54</sup> Gopal and Deller, *Precision Bombing, Widespread Harm*, op. cit.

<sup>55</sup> Ibid., p. 85.

<sup>56</sup> Ibid., p. 86.

<sup>57</sup> Ibid., p. 13.

<sup>58</sup> Alex J. Bellamy, *Just Wars: From Cicero to Iraq* (Cambridge: Polity, 2006), p. 213.

<sup>59</sup> See Brian Orend, "Is there a Supreme Emergency Exemption?" in Mark Evans, ed., *Just War Theory: A Reappraisal* (Edinburgh University Press, 2005), pp. 134-153.

<sup>60</sup> Michael Walzer, *Just and Unjust Wars: A Moral Argument with Historical Illustrations* (1977. Basic Books ed. 2000), pp. 251-262.

<sup>61</sup> Bacevich and Cohen, *War Over Kosovo*, p. 24.

<sup>62</sup> See my own, "NATO's War in the Balkans," op. cit., p. 2.

<sup>63</sup> Ibid.

<sup>64</sup> Ibid., p. 3. See also Ivo H. Daalder and Michael E. O'Hanlan, *Winning Ugly: NATO's War to Save Kosovo* (Washington DC: The Brookings Institution, 2000), pp. 91-93, 209. Dag Henriksen, *NATO's Gamble: Combining Diplomacy and Airpower in the Kosovo Crisis 1998-1999* (Annapolis: Naval

Institute Press, 2007), pp. 5, 199.

<sup>65</sup> Observing the conflict as it unfolded, I noticed a dramatic change of operational intensity and tempo in the fourth week of April 1999, coinciding with the NATO Summit in Washington. See my article, "NATO's War in the Balkans," cited above, p. 10. Eminent British defence commentator John Keegan saw the same shift, noting that NATO began to "visit a true blitz on the Serb homeland." John Keegan, "Please Mr Blair, Never Take Such a Risk Again," *Daily Telegraph*, 6 June 1999.

<sup>66</sup> Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I), Article 51 (5)(b) and Article 57 (2)(b).

<sup>67</sup> Statute of the International Criminal Court (Rome Statute), 17 July 1998, Article 8(2)(b)(iv). The Statute modifies "excessive" with the adjective "clearly" and "military advantage" with "overall," thereby emphasizing both the need for clarity and the importance of avoiding assessments of individual attacks in total isolation.

<sup>68</sup> David Rodin, "The Ethics of Asymmetric War" in Richard Sorabji and David Rodin, eds., *The Ethics of War: Shared Problems in Different Traditions* (Aldershot: Ashgate, 2006), p. 162.

<sup>69</sup> Austin and Bruch, *Environmental Consequences of War*, p. 651.

<sup>70</sup> *Final Report to the Prosecutor by the Committee Established to Review the NATO Bombing Campaign Against the Federal Republic of Yugoslavia* (§ I (15)). Austin and Bruch, *Environmental Consequences of War*, p. 652.

<sup>71</sup> See Michael D. Dieterich, Jr., "Law of War' and Ecology: A Proposal for

a Workable Approach to Protecting the Environment through the Law of War," *Military Law Review*, No. 136 (1992), pp. 137-160.

<sup>72</sup> ENMOD, Article I. The treaty can be read at: <http://fletcher.tufts.edu/multi/texts/BH700.txt>.

<sup>73</sup> Quoted in Gopal and Deller, *Precision Bombing, Widespread Harm*, p. 75.

<sup>74</sup> Aaron Schwabach, "Environmental Damage Resulting from the NATO Military Action against Yugoslavia," *Columbia Journal of Environmental Law*, Vol. 25, (2000), p. 129.

<sup>75</sup> For example, see Paolo Benvenuti, "The ICTY Prosecutor and the Review of the NATO Bombing Campaign against the Federal Republic of Yugoslavia," *European Journal of International Law*, Vol. 12, No. 3 (2001), pp. 503-529. Natalino Ronzitti, "Is the non liquet of the Final Report by the Committee Established to Review the NATO Bombing Campaign Against the Federal Republic of Yugoslavia acceptable?," *International Review of the Red Cross*, No. 840 (2000), pp. 1017-1028. For Amnesty International's response see: [http://www.essex.ac.uk/armedcon/story\\_id/000135.htm](http://www.essex.ac.uk/armedcon/story_id/000135.htm).

<sup>76</sup> *Final Report to the Prosecutor by the Committee Established to Review the NATO Bombing Campaign Against the Federal Republic of Yugoslavia*.

<sup>77</sup> Ibid. § 4 (A)(17)).

<sup>78</sup> Ibid. § 4 (A)(23)).

<sup>79</sup> *Depleted Uranium in Kosovo: Post-Conflict Environmental Assessment* (Geneva: United Nations Environment Programme, 2001) and *Depleted Uranium in Serbia and Montenegro: Post-Conflict Environmental Assessment in the Federal Republic of Yugoslavia* (Geneva: United Nations Environment Programme, 2002).

<sup>80</sup> Cf. "Defoliating Viet Nam," *Time*, 23

February 1968, which can be read at: <http://www.time.com/time/magazine/article/0,9171,837961,00.html>.

<sup>81</sup> *Fatal Footprint: The Global Human Impact of Cluster Munitions* (Brussels: Handicap International, 2006), p. 41.

<sup>82</sup> Secretary of State for Defence Geoff Hoon, House of Commons Hansard Written Answers for 19 January 2000. Minister of State for the Armed Forces Adam Ingram, House of Commons Hansard Written Answers for 16 November 2001. *Cluster Munitions in Kosovo: Analysis of Use, Contamination and Casualties* (London: Land Mine Action, 2007), pp. 9, 10. Richard Norton-Taylor, "US Deploys Controversial Weapon," *Guardian*, 12 October 2001.

<sup>83</sup> Ibid., p. 9. See the very close NATO figures quoted by the International Committee of the Red Cross in *Cluster Bombs and Landmines in Kosovo: Explosive Remnants of War* (Geneva: CRC, 2000), p. 6.

<sup>84</sup> *Cluster Munitions in Kosovo: Analysis of Use, Contamination and Casualties*, p. 43.

<sup>85</sup> "2,500 NATO Cluster Bombs Still Out There," B29 News, 11 March 2009. Helen Fawkes, "Scars of NATO Bombing still Pain Serbs," BBC News, 24 March 2009.

<sup>86</sup> *Cluster Munitions in Kosovo: Analysis of Use, Contamination and Casualties*, p. 46.

<sup>87</sup> House of Commons, Foreign Affairs Select Committee, Fourth Report, 23 May 2000, at para. 151.

<sup>88</sup> House of Commons, Defence Select Committee, Fourteenth Report, 23 October 2000, at para. 305.

<sup>89</sup> Secretary of State for International Development Hillary Benn, House of Commons Hansard Written Answers for 18 December 2006. *Fatal Footprint: The Global Human Impact of Cluster*

*Munitions*, p. 35.

<sup>90</sup> "Obama takes US Closer to Cluster Bomb Ban," *Guardian*, 13 March 2009.

<sup>91</sup> Robert Hewson, "Cluster Weapons Ban leaves Gap in UK Inventory," *Jane's Defense Weekly*, 10 April 2007. Richard Norton-Taylor, Peter Walker and agencies, "Cluster Bomb Treaty: Signing of Ban on Production Begins," *Guardian*, 3 December 2008.

<sup>92</sup> *From Conflict to Sustainable Development: Assessment and Clean-up in Serbia and Montenegro* (Geneva: United Nations Environment Programme, 2004), p. 7.

<sup>93</sup> Ibid., p. 6.

<sup>94</sup> Sasa Marković, "Serbia: Airing Grievances, Transitions, 28 September 2004.

<sup>95</sup> UNEP Press Release, 7 May 2004, available at: <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=397&ArticleID=4479&l=en>.

<sup>96</sup> Cf. Vesna Peric Zimonjic, "BALKANS: Fallout of Bombing 'Continues to Kill,'" *IPS*, 18 March 2009, which can be read at: <http://www.ipsnews.net/news.asp?idnews=46176>.

<sup>97</sup> Cf. [http://ngo.ro/pipermail/mediu\\_ngo.ro/2006-November/007156.html](http://ngo.ro/pipermail/mediu_ngo.ro/2006-November/007156.html).